

# Wildfire Exceptional Event

A satellite image showing a large wildfire event. The image displays a vast area of land with a mix of brown, tan, and green colors, indicating a combination of burned and unburned vegetation. A prominent, irregularly shaped white and light gray plume of smoke or ash rises from the center-right of the image, extending towards the top right. The plume has a textured, billowing appearance. The surrounding land shows a complex pattern of dark green and brown patches, suggesting a forested area with varying degrees of fire impact. The overall scene is captured from a high-altitude perspective, typical of satellite imagery.

PM2.5  
July 9, 2007  
Lindon

Photo from MODIS, July 8, 2007

Photos Furnished by: NASA

# Purpose of Report

- UDAQ is flagging PM2.5 data for removal from regulatory consideration
  - This is the follow-up documentation for the event that was flagged and described in AQS

# Regulatory Process

- Treatment of Data Influenced by Exceptional Events is covered in 40 CFR Parts 50 and 51.
- Guidance for the regulations can be found at 72 FR 55 March 22, 2007 13560-81.

# Event Description

- Date: July 9, 2007
- Monitor: Lindon
- 24 hour Avg.: 44.3  $\mu\text{g}/\text{m}^3$
- AQS monitor #: 49-049-4001
- Monitor Location: UTM
  - Zone 12
  - Northing 4465406
  - Easting 430337

# Event Description (Cont)

- The following slides will address each of the required elements of the exceptional events regulation regarding this data point.
- A weight of evidence will be provided that concludes this data should be removed from regulatory consideration.



# Event Qualifies as an Exceptional Event

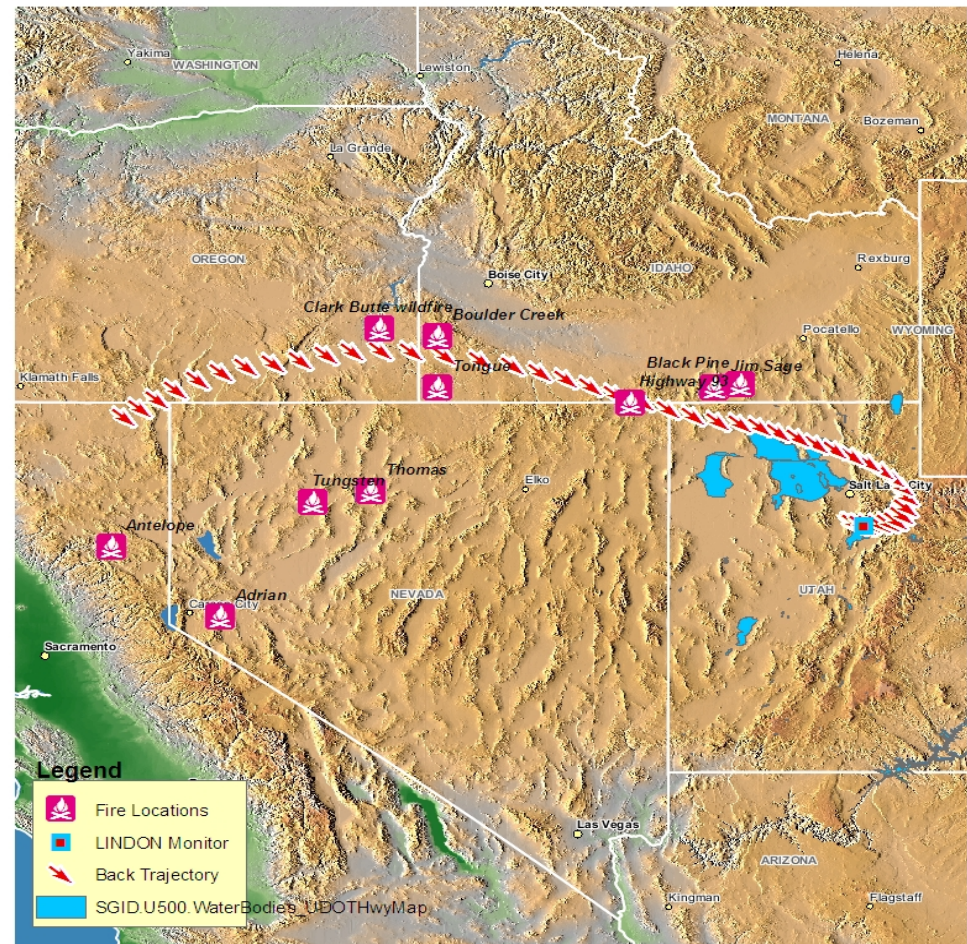
- Section IV E of the guidance (72 FR 55 March 22, 2007 13564-67) lists wildfires as a type of natural event.
- This event is a wildfire.



# Clear and Causal Relationship

- There were several fire complexes burning on this day that were up wind of the monitor.
- These complexes are also shown on the satellite image on the next slide.
- The back trajectory analysis uses the Hysplit model, EDAS 40 km data, and charted with GIS mapping.
  - The air mass arrived at the Lindon Monitor at 12:00 Hours MDT on July 9, 2007.
  - Each arrow represents 1 hour of elapsed travel time.

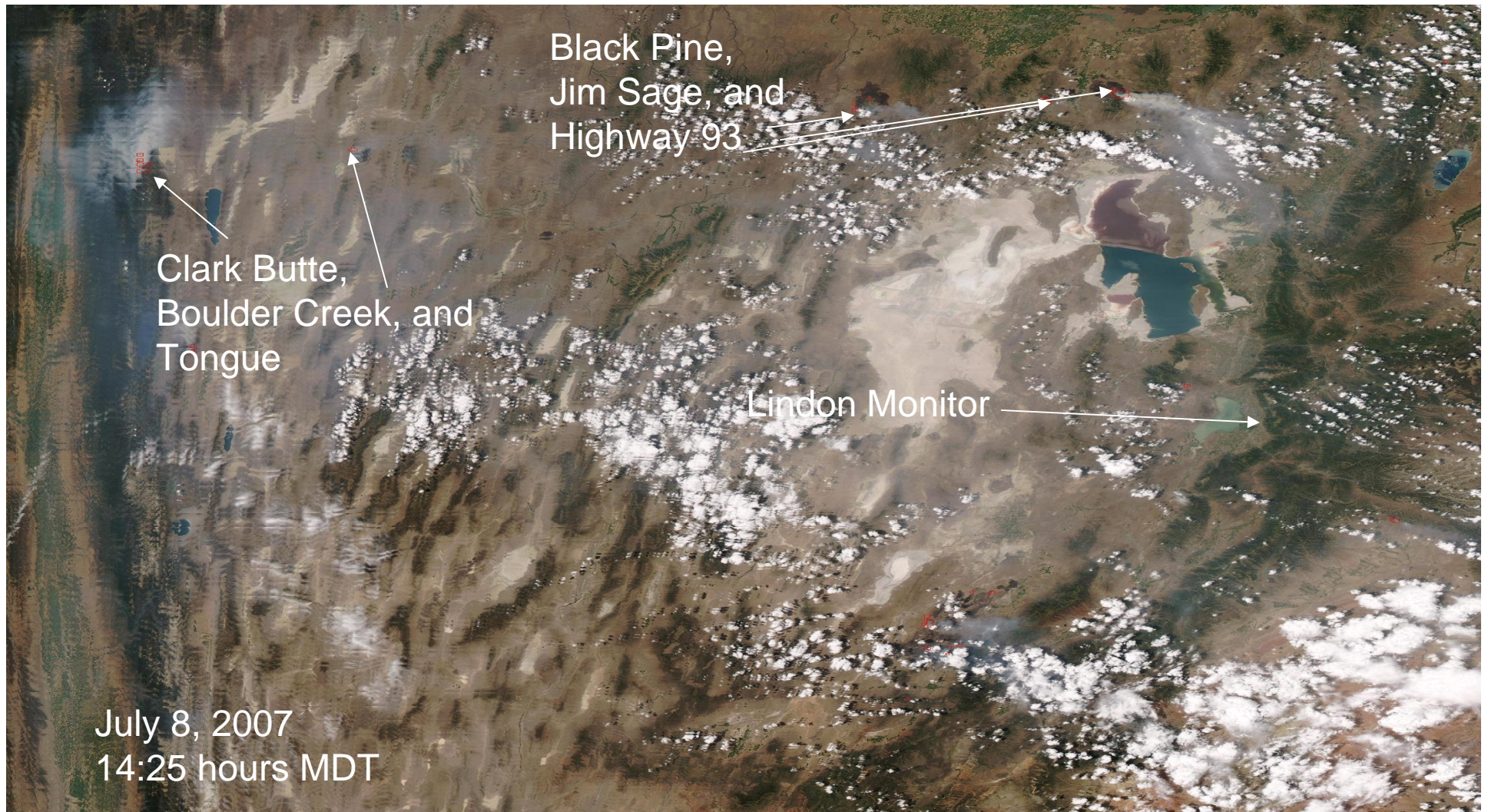
48 Hour Back Trajectory of the Air Mass  
Lindon Monitor  
July 9, 2007





# Clear and Causal Relationship

(Cont)





# Clear and Causal Relationship

(Cont)

- The date of the satellite image in the previous slide is July 8, 2007 (the day before the event) and illustrates available atmospheric smoke for transport.
- The timing of the satellite image is coincident with the first half of the back trajectory analysis.

# Clear and Causal Relationship

(Cont)

- The image in the next slide shows regional impact from these wildfires.
- The image is a super position of smoke plumes from all the western wildfires burning on July 9, 2007. This is based on satellite images compiled by NOAA.
- The slide illustrates the impact from smoke plumes on the majority of the state.

**Satellite Fire Detections - Microsoft Internet Explorer**

File Edit View Favorites Tools Help

Back Forward Stop Reload Home Search Favorites RSS Print Mail News Groups Shopping

Address <http://map.ngdc.noaa.gov/website/firedetects/viewer.htm> Go Links

Google Go Bookmarks Popups okay Check AutoLink AutoFill Send to Settings

Search Web Mail My Yahoo! Shopping Games Music

**NOAA Satellite and Information Service**  
National Environmental Satellite, Data, and Information Service (NESDIS)

**Satellite Fire Detections**  
National Geophysical Data Center

NOAA > NESDIS > NGDC > Maps

Map Generated by the National Geophysical Data Center

**Date Constraint** ☒

From: 2007 Jul 9 To: 2007 Jul 9 custom range

**Pan** -118.08, 32.25 **About this project** **Help ?** **idle**

Done Internet

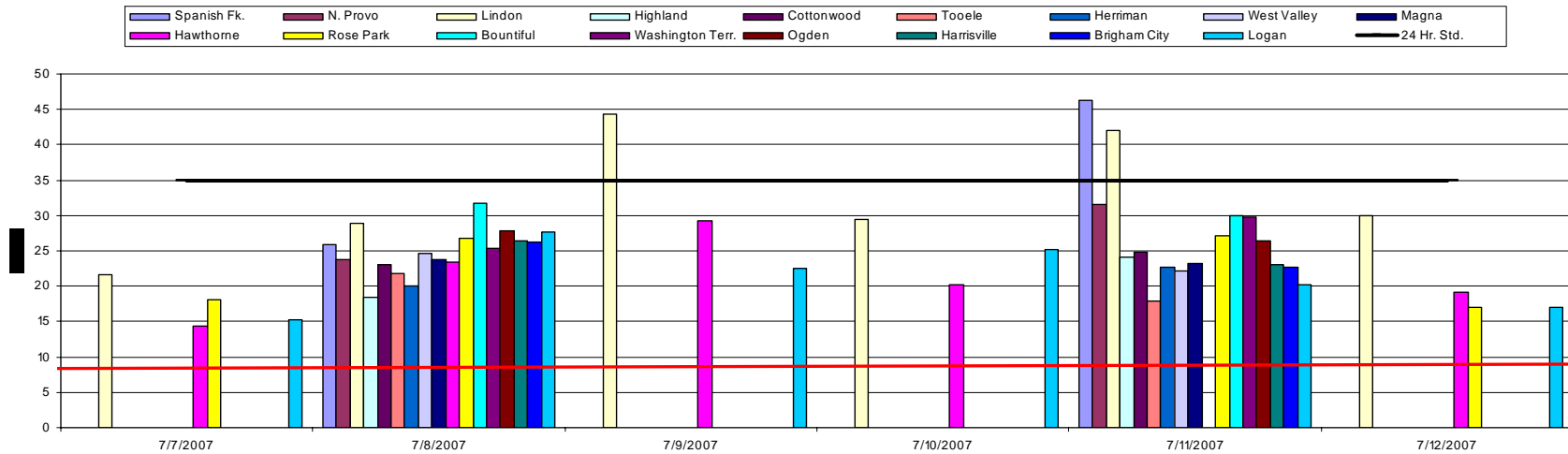
start DE... No... 2 18 2 Desktop Links 4:31 PM



# Clear and Causal Relationship

(Cont)

Wasatch Front  
PM<sub>2.5</sub> 24 Hr. Measured Filter Values  
July 7 to 12, 2007



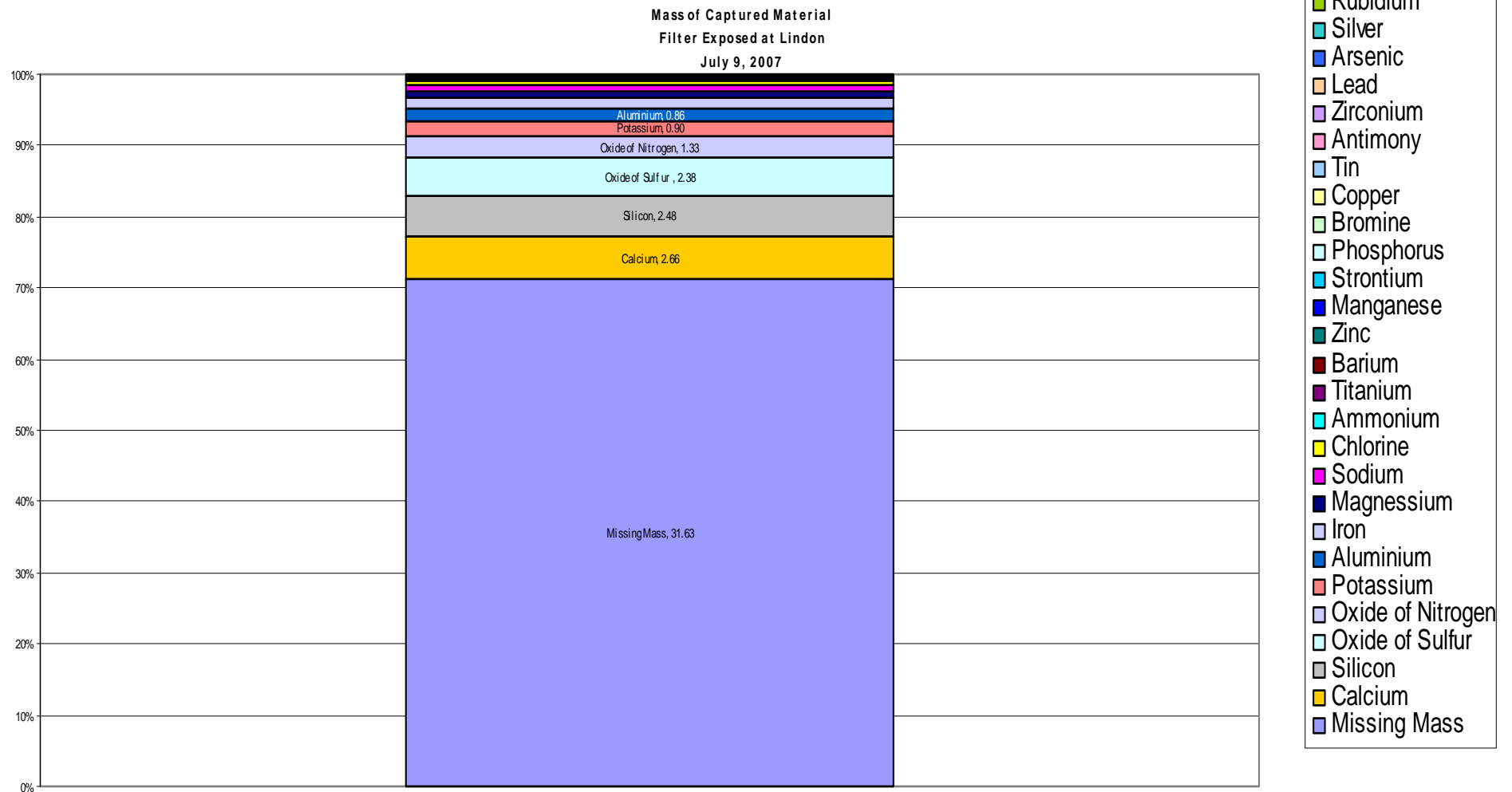
- This chart shows data collected from the entire network area, and shows that all the values were elevated on several days surrounding the event.
- A more typical value ( $8.8 \mu\text{g}/\text{m}^3$ ) for this season, including normal historical fluctuations is indicated by the red line (see slides 17 through 19 for more information).

# Clear and Causal Relationship (Cont)

Additional evidence comes from the filter analysis (see next slide).

- This sample is dominated by missing mass
- It is not distinguishable from the Teflon filter on which it was collected
- Most of this mass is carbon, due to the smoke from the fires
- A more typical filter would contain some missing mass (carbon), but not nearly as much
- Speciated data from Lindon suggests that missing mass on a typical day in this season would be roughly  $5.9 \mu\text{g}/\text{m}^3$ 
  - Estimated as:  $[(\text{Elemental Carbon}) + 1.4 \times (\text{Organic Carbon})]$

# Clear and Causal Relationship (Cont)





# Concentration in Excess of Normal Fluctuations

Statistics from this event reveal the following:

- The geometric mean value could be used to describe a background concentration
- The geometric mean was calculated to be  $7.2 \mu\text{g}/\text{m}^3$ .
  - Ten-years of historical data was used for the calculation.
  - All data points from June 1 through August 31 for the years 1998 through June 30, 2007 were included.
    - This is statistically characteristic of the summer air quality season.
- Normal historical fluctuation might be described as one geometric standard deviation above or below the geometric mean. The upper bound of this fluctuation for the Lindon monitoring site would then be  $8.7 \mu\text{g}/\text{m}^3$ .

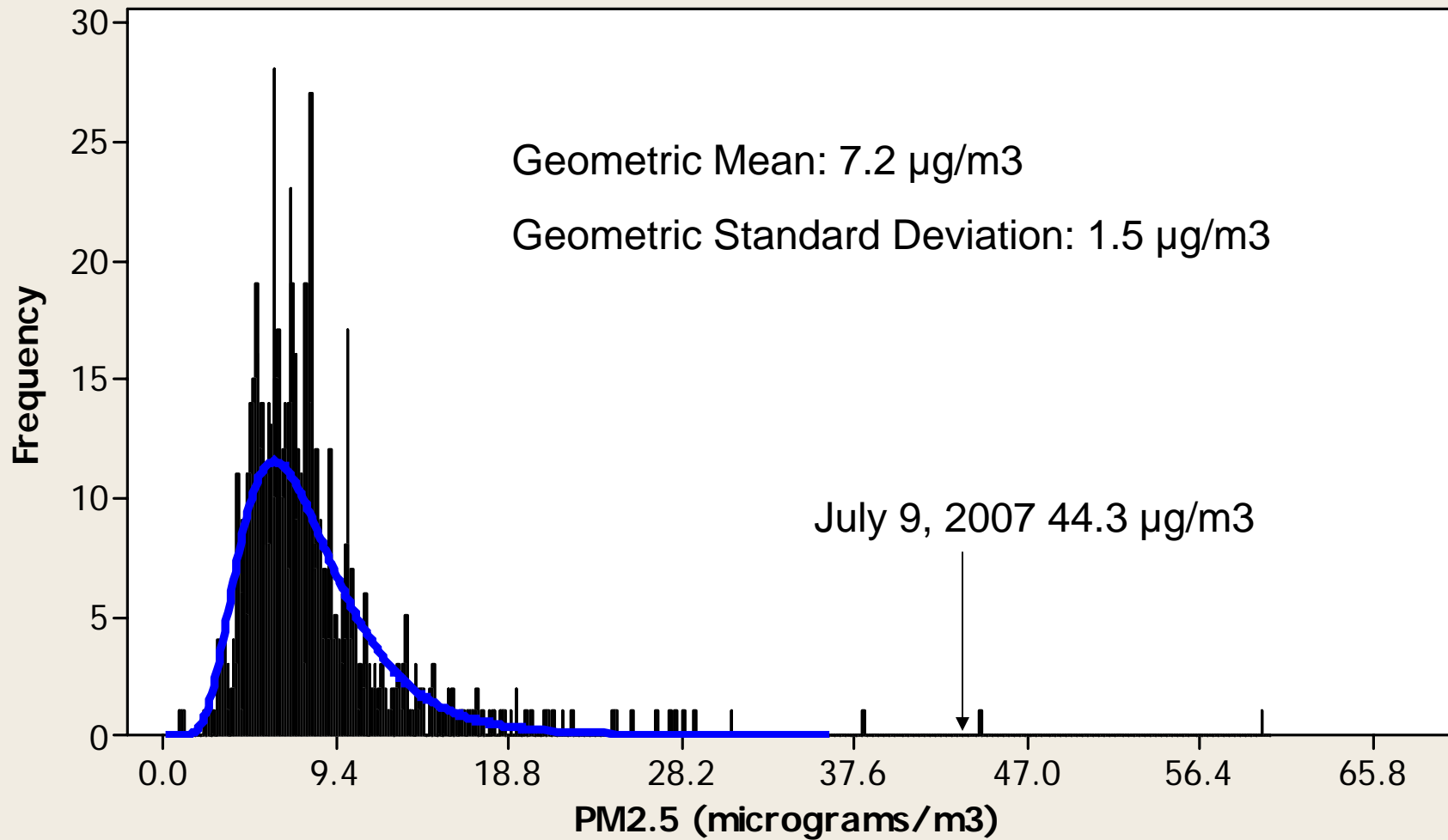
# Concentration in Excess of Normal Fluctuations (Cont)

The measured concentration associated with this event is shown in the graph on the next slide.

- Clearly the measured concentration exceeds  $8.7 \mu\text{g}/\text{m}^3$
- From June 1998 through June of 2007, only 5 days have been above the 24-hour NAAQS, these days were influenced by either fireworks or forest fires. Summertime exceedances of the 24-hour NAAQS are therefore not seen in the normal variation of the Lindon data.
- In fact, it fall above the 99<sup>th</sup> percentile of all summertime values measured at this site.
- Guidance found at 72 FR 55 March 22, 2007 13560-81, says that a lesser amount of documentation would likely be necessary for “extremely high” concentrations (e.g. > 95th %ile) than for concentrations that were closer to “typical levels” (e.g. < 75th %ile.)

# Lindon June 1, 1997-June 30, 2007

Lognormal





# No Exceedance or Violation “but for” the Event

- For the time period surrounding this event one might have expected a background concentration (geometric mean) of 7.2  $\mu\text{g}/\text{m}^3$ .
  - Calculation of the geometric mean was already described in slide 15.
- This is well below the current 24-hour PM<sub>2.5</sub> NAAQS standard.

# No Exceedance or Violation “but for” the Event (Cont)

- Measured concentration associated with the event was  $44.3 \mu\text{g}/\text{m}^3$ .
- The difference between the measured concentration and the expected background is  $37.1 \mu\text{g}/\text{m}^3$ .
- This difference could be considered the amount of impact from the event.

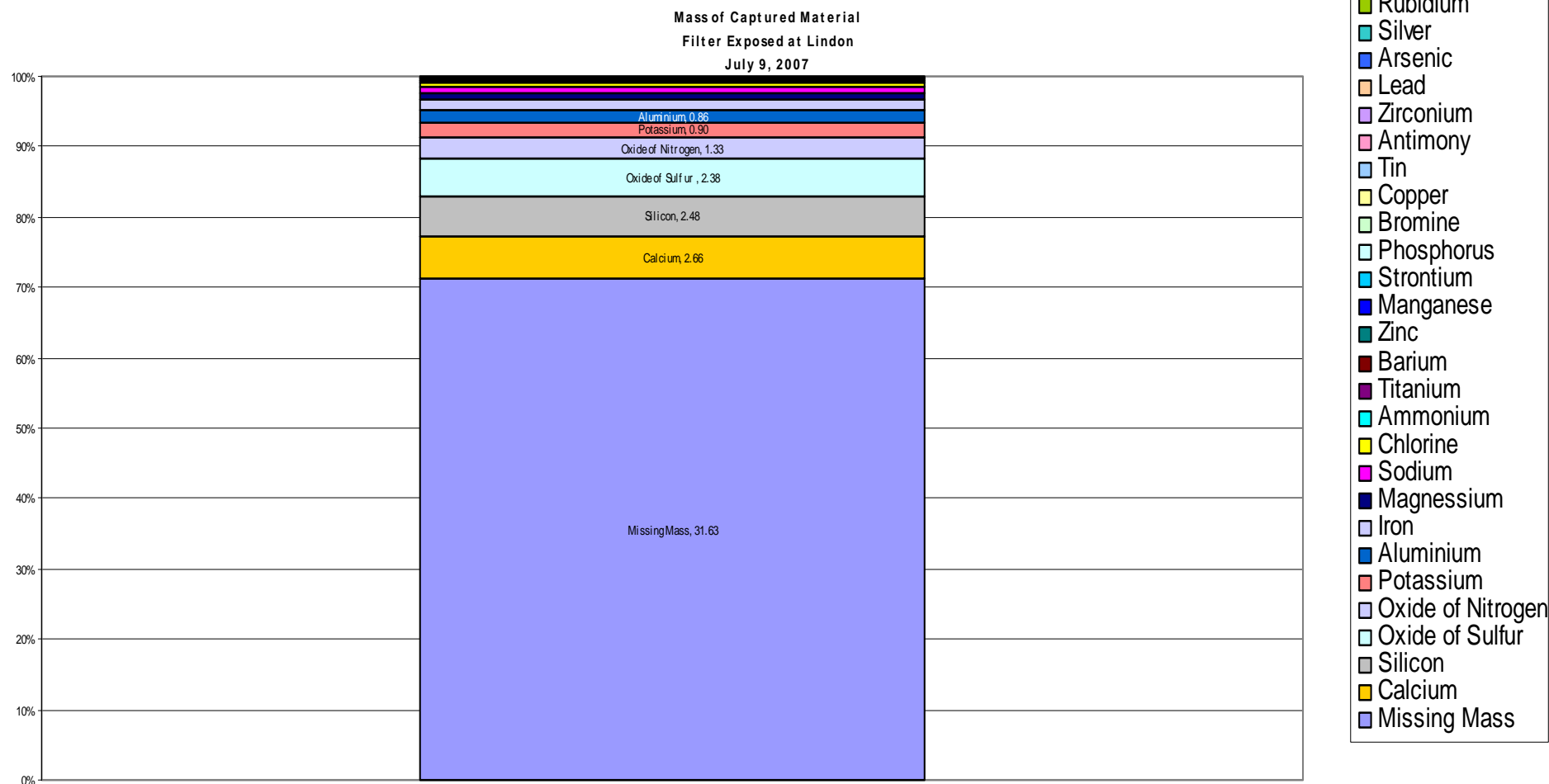
# No Exceedance or Violation “but for” the Event (Cont)

- However, to account for typical fluctuations we must subtract a representative amount.
  - Again, this might be described by one geometric standard deviation above the mean.
  - In this case one geometric standard deviation equates to  $1.5 \mu\text{g}/\text{m}^3$ .
- Hence, the amount of concentration that would be attributable to the event using this approach is  **$35.6 \mu\text{g}/\text{m}^3$** .

# No Exceedance or Violation “but for” the Event (Cont)

- Analysis of filter chemistry reveals that  $31.6 \mu\text{g}/\text{m}^3$  is associated with the missing mass.
- As explained on slide 13 the majority of the missing mass is likely attributable to smoke from wildfire.
- Assuming a typical filter would contain roughly  $5.9 \mu\text{g}/\text{m}^3$  carbon compounds one could still attribute  **$25.1 \mu\text{g}/\text{m}^3$**  of this missing mass to the wildfire event.

# No Exceedance or Violation “but for” the Event (Cont)





# No Exceedance or Violation “but for” the Event Summary

- Using the statistical approach discussed in slides 15-20 the concentration attributable to the event is **37.1  $\mu\text{g}/\text{m}^3$** .
- Using the filter analysis approach discussed in slides 21-22 the concentration attributable to the event is **25.1  $\mu\text{g}/\text{m}^3$** .
- Both numerical approaches suggest that a sufficient concentration was attributed to the wildfire event and that the measured concentration would not have exceeded the PM2.5 24-hour NAAQS **but for** the impact of emissions from the wildfire complexes!

# Mitigation of Event

State Action included:

- A Smoke management rule and plan that helps minimize smoke from other sources during the event.
  - The rule and plan state that new prescribed fires and new wildland fire use events would not be approved if there was a potential to exceed the NAAQS.
- A news release during the episode that advised citizens of the potential health impacts of smoke from wildfires.
  - Staff also participated in interviews with news media (both print and TV).
- A series of websites (see next slide) about emissions from wildfire were posted on the web during the event.
- Specifically they covered the following items:
  - The health impacts of PM
  - The actions a person could take to minimize exposure to PM.

# Mitigation of Event (Cont)

